DEFINING THE RELATIONSHIP BETWEEN BIOMARKERS OF OXIDATIVE AND INFLAMMATORY STRESS AND THE RISK FOR ATHEROSCLEROSIS IN ASTRONAUTS DURING AND AFTER LONG-DURATION SPACEFLIGHT

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BACKGROUND

Future human space travel will primarily consist of long-duration missions aboard the International Space Station (ISS) or exploration class missions to Mars, its moons, or nearby asteroids. These missions will expose astronauts to increased risk of oxidative and inflammatory damage primarily from radiation, but also from psychological stress, reduced physical activity, diminished nutritional status, and, in the case of extravehicular activity, hyperoxic exposure. There is evidence that increased oxidative damage and inflammation can accelerate the development of atherosclerosis.

PURPOSE

The purpose of this proposal is to identify biomarkers of oxidative and inflammatory stress and to correlate them to indices of atherosclerosis risk before, during, and after long-duration spaceflight.

METHODS

To meet the objectives of the study, we will study astronauts before, during, and up to 5 years after long-duration missions aboard ISS. Biomarkers of oxidative and inflammatory stress, some of which we have previously shown to be elevated with spaceflight, will be measured before, during, and after spaceflight. Arterial structure will be monitored using ultrasound to measure carotid intima-medial thickness before, during, and after weightlessness. Carotid intima-medial thickness has been shown to be a better indicator than Framingham Risk scores for prediction of atherosclerosis. Arterial function will be monitored using brachial flow-mediated dilation before flight and after landing. Brachial flow-mediated dilation is a good index of endothelium-dependent vasodilation, which is a sensitive predictor of atherosclerotic risk. This is the first study to propose assessing atherosclerotic risk using biochemical, structural, and functional measures before, during, and immediately after spaceflight and structural functional measures for up to 5 years after landing.

EXPECTED RESULTS

We hypothesize that these biomarkers of oxidative and inflammatory stress will be increased with spaceflight and will correlate with increased carotid intima-medial thickness in- and postflight and with decreased flow-mediated dilation after the mission. Furthermore, we hypothesize that measures of oxidative stress will return to baseline after flight, but that biomarkers of inflammatory stress and vascular indices of atherosclerosis risk will remain elevated.